

**This Page Is Inserted by IFW Operations  
and is not a part of the Official Record**

## **BEST AVAILABLE IMAGES**

**Defective images within this document are accurate representations of  
the original documents submitted by the applicant.**

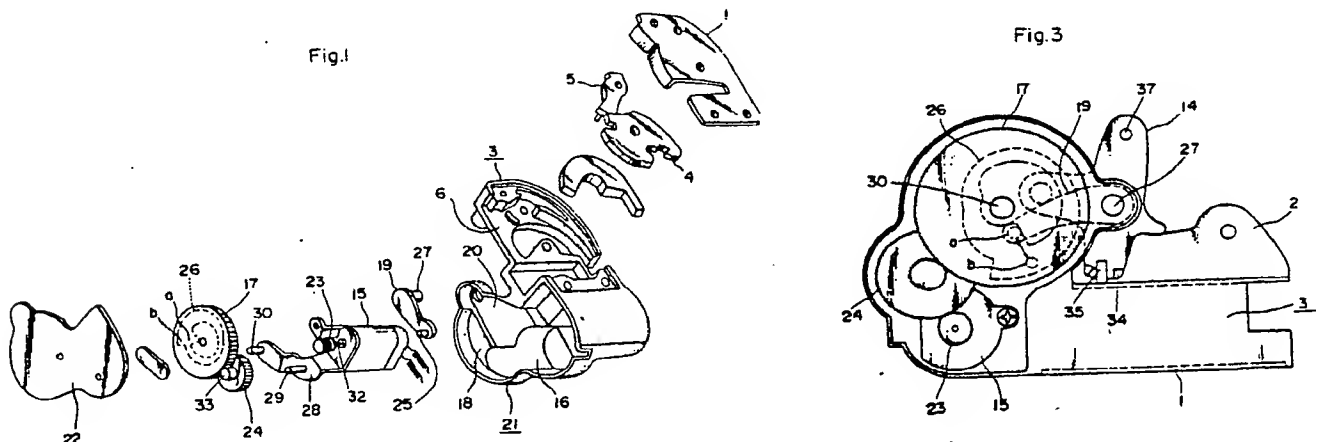
**Defects in the images may include (but are not limited to):**

- **BLACK BORDERS**
- **TEXT CUT OFF AT TOP, BOTTOM OR SIDES**
- **FADED TEXT**
- **ILLEGIBLE TEXT**
- **SKEWED/SLANTED IMAGES**
- **COLOR PHOTOS**
- **BLACK OR VERY BLACK AND WHITE DARK PHOTOS**
- **GRAY SCALE DOCUMENTS**

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

**THIS PAGE BLANK (USPTO)**



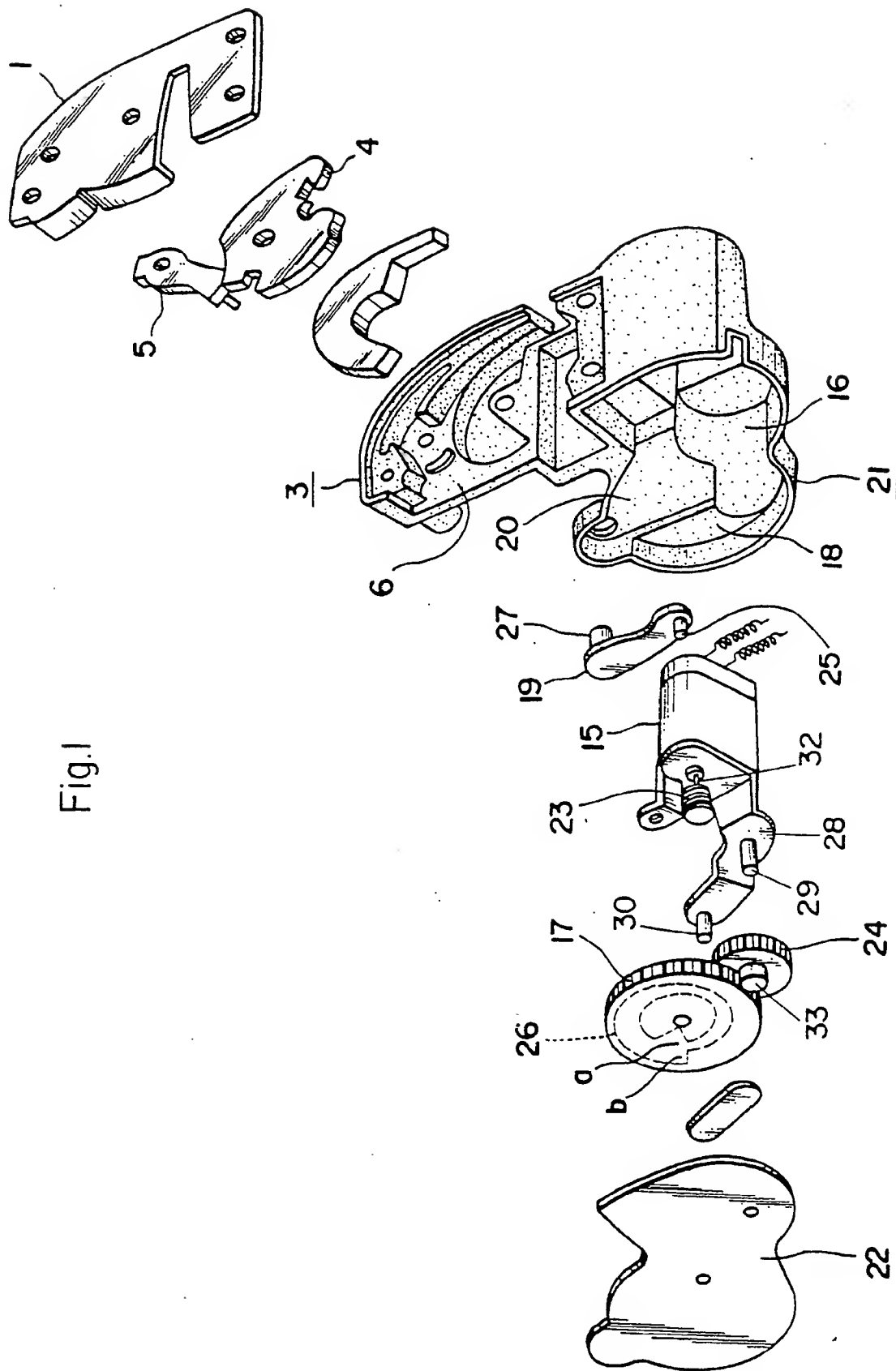


Fig.1

Fig. 2

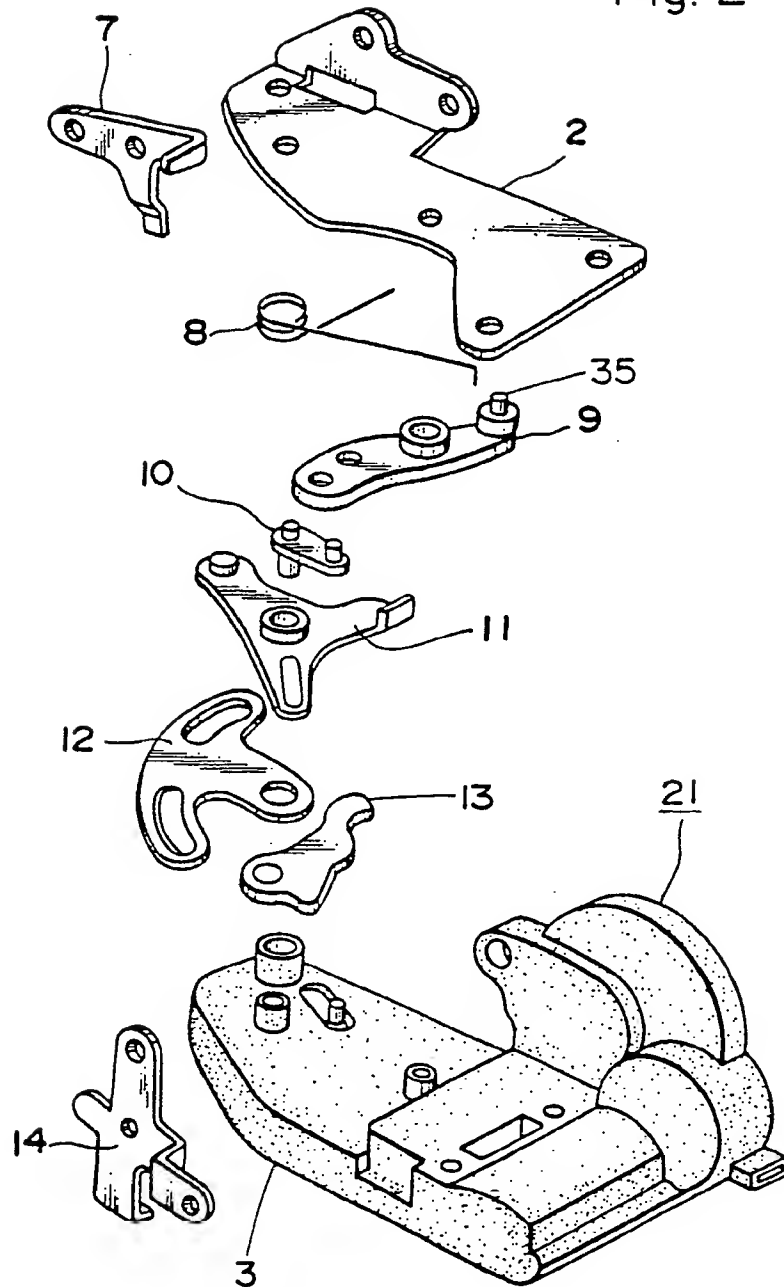
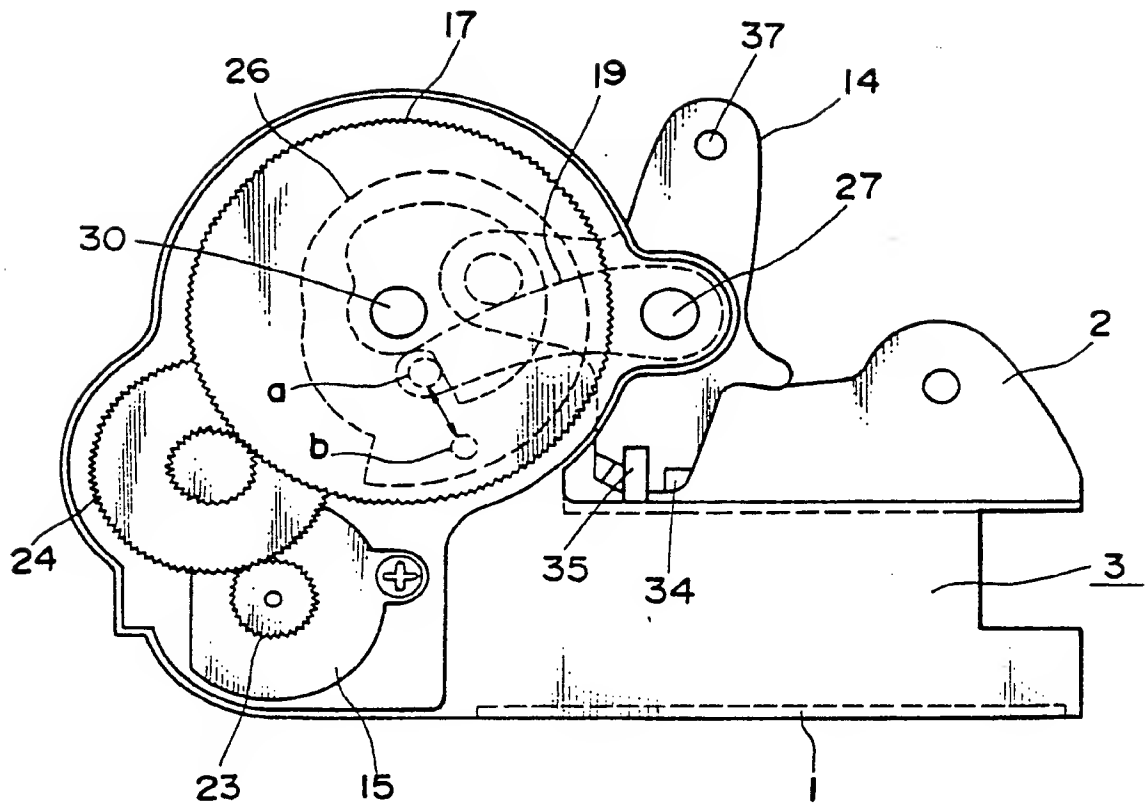


Fig.3



LOCKING DEVICE FOR VEHICLE

This invention relates to a locking device of the kind which in use is mounted in a vehicle door to engage with a striker mounted in the vehicle.

Hitherto there has been known a structure in which a body made of a synthetic resin is assembled between a cover and a back plate made from a metal sheet and has a recess, in which a latch and a pawl are accommodated. There has also been known a structure provided with an actuator consisting of a motor and a reduction gear train for automatically switching a locking lever between lock and unlock positions, the locking lever serving to switch between lock and unlock states a locking device provided on the outer side of a plate mounted in a vehicle.

The well-known actuator for automatically switching the locking lever between the lock and unlock positions as noted above is fabricated separately of the locking device and secured by means of screws to the device.

Inconvenience, therefore, is encountered in that:

- (a) the entire structure has a large size; and
- (b) extra labour and expense are required for mounting.

An object of the present invention is to provide a locking device for a vehicle which is of smaller size and in which the actuator is assembled integrally in the synthetic resin body.

Another object of the invention is to reduce extra labour and expense for mounting.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a front exploded perspective view showing parts of an embodiment of the locking device according to the invention;

Figure 2 is a rear exploded perspective view showing parts of the same locking device; and

Figure 3 is a side view showing the same locking device with a cover removed to show an accommodating section accommodating a motor and other components.

Referring to the drawings, numeral 1 designates a cover made from a metal sheet, numeral 2 designates a back plate made from similar metal sheet, and numeral 3 designates a body made of a synthetic resin. The body 3 is clamped between the cover 1 and back plate 2. These parts 1 to 2 are secured to one another by screws or caulking pins.

The synthetic resin body 3 has a recess 6, in which are accommodated a latch 4 rotatable for engagement with a striker secured to the vehicle and a pawl 5 for engagement with half and full latch engagement shoulders formed on the outer periphery of the latch 4 to prevent reverse rotation of the latch 4.

The back plate 2 made from metal sheet is mounted on the rear of the synthetic resin body 3.



As in a well-known locking device for vehicles, there are an inner lever 7 rotatable by a door inner handle, a spring 8, a locking lever 9 for switching the device to lock and unlock states, a link 10, an adjustment rod 12 connected to a door outer handle, an opening lever 11 connected to the adjustment rod 12, a connector cam lever 13 rotatable with the rotation of the opening lever 11 for releasing the pawl 5 and an actuator operation link 14, these components being mounted on the outer side of the back plate 2 of metal sheet.

The body 3 of synthetic resin has an integral synthetic resin case 21, which has a recess 16 for accommodating a switching motor 15, a recess 18 for accommodating a cam gear 17 rotatable from the switching motor 15 and a recess 20 for accommodating a switching lever 19 rotatable with operation of a sill knob mounted on the vehicle door.

The switching motor 15 is inserted in the recess 16, an intermediate speed-reduction gear 24 is loosely fitted on a shaft 29 provided on a mounting member 28, on which the switching motor 15 is mounted, and an output gear 23 secured to an output shaft 32 of the switching motor 15 is meshed with the intermediate gear 24.

A small gear 33 which is integral with the speed-reduction gear 24 is meshed with the cam gear 17. The cam gear 17 is secured to the shaft 30 provided on the mounting member 28. The gears are accommodated in the recess 18 of the synthetic resin case 21.

The switching lever 19 is accommodated in the recess of the synthetic resin case 21, and a lid 22 closes the recess 21.

The cam gear 17 is formed on one side thereof with a cam groove 26, which surrounds the shaft 30 and has a first end a closer to the shaft and a second end b more remote from the shaft. The switching lever 19 has a projection 25 engaged in the cam groove 26. The ends a and b are formed on an orbit of the projection 25 of the switching lever 19 such that they are radially staggered with respect to each other. When the cam gear executes one rotation, therefore, the projection 25 of the switching lever 19 in engagement with the cam groove 26 is displaced from the first end a to the second end b. When the projection 25 is brought to the first end a, the locking device assumes a lock state. When the projection 25 is brought to the second end b, the device assumes an unlock state.

Reference numeral 27 designates a pivotal pin provided on the switching lever 19. The pin 27 penetrates a through hole 36 formed at the bottom of the recess 20 to the outside, and the actuator operation link 14 is secured at the projecting end of the pin 27. The locking lever 9 has a projection 35 engaging with an end 34 of the actuator operation link 14. Reference numeral 37 designates a coupling section of the sill knob.

#### Operation

Now, the operation will be described.

#### Operation Brought About by Switching Motor 15

When the switching motor 15 is energised, the speed-reduction gear 24 is rotated by the output gear 23 to cause rotation of the cam gear 17 via the small gear 33 integral with it. The rotation of the cam groove 17 causes the projection 25 having been at the first end a, i.e., lock position, to be moved along the cam groove 26 to the second end b, i.e., unlock position.

The movement of the projection 25 from the lock position a to the unlock position b causes rotation of the switching lever 19 with the shaft 27, thus causing rotation of the actuator operation link 14 secured to the shaft 27. Since the projection 35 of the locking lever 9 is engaged with the end 34 of the actuator operation link 14, the rotation of the lever 14 causes rotation of the locking lever 9 to switch the locking device to an unlock state.

When the switching motor 15 is driven in the reverse direction, a converse operation takes place, that is the projection 25 having been at the unlock position b is returned along the cam groove 26 to the lock position a.

#### Manual Operation

Since the first and second ends a and b of the cam groove 26 of the cam gear 17 are formed on the orbit of the projection 25 about the shaft 27 of the switching lever 19, the former at the lock position and the latter at the unlock position, as noted above, when the switching lever 19 is turned manually, the projection 25 is moved about the shaft 27 between the first and second ends a and b.

This means that when the sill knob connected to the coupler 37 of the actuator operation link 14 is turned manually, the link 14 is rotated with the shaft 27 to cause rotation of the switching lever 19 secured to the shaft 27. The projection 25 thus is moved from the lock position a to the unlock position b or vice versa, while at the same time the locking lever 9 is moved by the end 34 of the actuator operation link 14. In this way, the locking device is switched between the lock and unlock states.

### Effectiveness of the Invention

As has been described in the foregoing, according to the invention the synthetic resin body 3 between the metal sheet cover 1 and metal sheet back plate is formed with the recess 6 which accommodates the latch 4 and pawl 5 and has the integral synthetic resin case 21 with the recess 16 which accommodates the switching motor 15, the recess 18 which accommodates the gears rotated by the switching motor 15 and the recess 20 which accommodates the switching lever 19 engaged in the cam groove 26 of the cam gear 17 and switched between the lock and unlock positions, with the switching motor 15 accommodated in the recess 16, the cam gear 17 accommodated in the recess 18 and the switching lever 19 accommodated in the recess 20. Since the synthetic resin body 3 and the synthetic resin case 21 are integral with each other, the manufacture can be simplified, and its price can be reduced. Further, the device can be readily assembled, and the accuracy of assembly can be improved.

Furthermore, the device can be used both automatically and manually.

CLAIMS

1. A locking device for a vehicle comprising a cover made from a metal sheet, a back plate also made from a metal sheet and a body made of a synthetic resin and having a recess for accommodating a latch and a pawl, said synthetic resin body being assembled between said cover and back plate and having an integral synthetic resin case accommodating a switching motor, a cam gear rotatable by said switching motor and a switching lever engaging in a cam groove formed in said cam gear and switchable between lock and unlock positions.

2. A locking device according to Claim 1, wherein said cam groove of said cam gear surrounds the axis of said cam gear.

3. A locking device according to Claim 1 or 2 wherein said cam groove of said cam gear has a first end closer to the cam gear axis and a second end more remote from said cam gear axis, said first end being formed at a lock position, said second end being formed at an unlocked position, and said first and second ends being formed on an orbit of a projection of said switching lever.

4. A locking device substantially as described herein with reference to the accompanying drawings.

**THIS PAGE BLANK (USPTO)**